BIOMONITORING CONTAMINANT EXPOSURE AND EFFECTS IN FISH OF THE SACRAMENTO–SAN JOAQUIN DELTA

Swee Joo Teh

Public Comments

No public comments were received for this proposal.

Collaboration Panel Review

Proposal Title

#0220: BIOMONITORING CONTAMINANT EXPOSURE AND EFFECTS IN FISH OF THE SACRAMENTO−SAN JOAQUIN DELTA

Final Panel Rating
inadequate

Collaboration Panel (Primary) Review

Collaboration:

Will the results of the collaborative effort be greater than the sum of its parts? Is it clear why the subprojects are part of a larger collaborative proposal rather than several independent smaller ones?

adequate
Not sure this is trully a collaborative effort? Not clear.

Interdependence And Integration:

Does the proposal have an example that clearly articulates the conceptual model of each subproject and how they link together as a whole? Are the boundaries of the study plans focused and cohesive, yet well delineated? Is there a plan for potential differences in the stages of subproject completion times? Are there clear plans for analyses and interpretations which seek to identify and quantify relationships among the data collected in various subprojects rather than separate analyses for each subproject?

adequate
Conceptual model articulated. Study plans described. No plan for differences in completion times. Not clear regarding analyses and synthesis.

Project Management:

Is it clear who will be performing management tasks and administration of the project? Are there resources set aside for project management and time given for investigators to

collaborate? Is there a process for making decisions during the course of the project? Are there acknowledgments of potential barriers to collaboration and explanations of how team members will overcome barriers particular to their institutions?

adequate
Project manager is identified and resources are set aside. Collaboration time is not evident. Process for decision−making and overcoming obstacles are not described.

Team Composition:

Does the lead principal investigator have successful management history and experience leading collaborative teams? Is it clear that all key personnel are committed to making significant contributions to the project? Do team members have complementary skills?

adequate
Mangement history and experience leading collaborative teams not described. Team members have complementary skills and are committed to making contributions to the project.

Communication Of Results:

Is there a clear plan for comprehensive and cohesive reporting of project progress to the CALFED community?

inadequate
Communication of results is not clear − vague.

Additional Comments:

Collaboration Panel (Discussion) Review

Both Primary and secondary reviewers judged this proposal as Inadequate. The entire panel agreed.

Technical Synthesis Panel Review

Proposal Title

#0220: BIOMONITORING CONTAMINANT EXPOSURE AND EFFECTS IN FISH OF THE SACRAMENTO−SAN JOAQUIN DELTA

Final Panel Rating
adequate

Technical Synthesis Panel (Primary) Review

TSP Primary Reviewer's Evaluation Summary And Rating:

This proposed 3−year study will focus on assessing chemical contaminant levels in key fish species in the Yolo Bypass and Suisan Marsh areas and evaluating the health of these fish populations. The goals are to be accomplished through contaminant analysis, biomarker study, and histopathology to develop a site−specific fish health index. The overarching goal of this project is to fill data gaps necessary for evaluating CALFED restoration activities and evaluating contaminant effects on key species. The goals and objectives of this proposal are clearly defined. The authors are highly knowledgeable about this research area and fully capable of successful project completion. Using the ASUM program, the investigators plan to generate a site−specific health index which will be integrated into current long−term monitoring projects. I think this would be a valuable tool for evaluating the effectiveness of restoration projects and facilitate adaptive management. Based on this proposal, limited knowledge on contaminants in the CALFED region exists. This information is vital for restoration planning in the shallow water habitats of Yolo Bypass and Suisan Marsh. Although the underlying purpose of this proposal is very important, it lacks clear justification. Clarification on the current level of contaminants and background on the site would improve my

understanding of CALFED issues. The approach section needs to be redesigned before proceeding with this project for several reasons. It is unclear on how population level assessments will be accomplished and if sampling will be adequate to evaluate population level impacts. If sample size will not be representative of fish populations perhaps it would be more informative to sample a smaller number of fish and increase the number of species sampled. This information would provide insight into the impacts of chemical contaminants at different trophic levels and identify sensitive species. Additionally, migratory fish movement is not addressed (sampling sites are relatively close and movement is highly probable).

Additional Comments:

The following is a summary of the three technical reviewers' comments: Although this is not a novel project, it has worthy objectives that will provide useful information. The reviewers suggest reducing the budget since it is costly and will not provide population level assessments. Also, some of the reviewers felt it was a shotgun approach of collecting data on numerous parameters and opted for the development of a smaller, more specific project (e.g., evaluates one fish species of interest, conduct one year of sampling to provide proof-of-concept).

This proposed 3-year study will focus on assessing chemical contaminant levels in key fish species in the Yolo Bypass and Suisan Marsh areas and evaluating the health of these fish populations. The goals are to be accomplished through contaminant analysis, biomarker study, and histopathology to develop a site-specific fish health index. The overarching goal of this project is to fill data gaps necessary for evaluating CALFED restoration activities and evaluating contaminant effects on key species. The goals and objectives of this proposal are clearly defined. The authors are highly knowledgeable about this research area and fully capable of successful project completion. Using the ASUM program, the investigators plan to generate a site-specific health index which will be integrated into current long-term monitoring

projects. I think this would be a valuable tool for evaluating the effectiveness of restoration projects and facilitate adaptive management. Based on this proposal, limited knowledge on contaminants in the CALFED region exists. This information is vital for restoration planning in the shallow water habitats of Yolo Bypass and Suisan Marsh. Although the underlying purpose of this proposal is very important, it lacks clear justification. Clarification on the current level of contaminants and background on the site would improve my understanding of CALFED issues. The approach section needs to be redesigned before proceeding with this project for several reasons. It is unclear on how population level assessments will be accomplished and if sampling will be adequate to evaluate population level impacts. If sample size will not be representative of fish populations perhaps it would be more informative to sample a smaller number of fish and increase the number of species sampled. This information would provide insight into the impacts of chemical contaminants at different trophic levels and identify sensitive species. Additionally, migratory fish movement is not addressed (sampling sites are relatively close and movement is highly probable).

Technical Synthesis Panel (Discussion) Review

TSP Observations, Findings And Recommendations:

Biomonitoring contaminant exposure and effects in fish of the Sacramento−San Joaquin Delta

The panel found that the project techniques were technically sound. However, the panel considered this proposal to be a very expensive shotgun approach to data collection with little insight on what to do with data when collected. A lot of data would be collected, but it would be difficult to tie contaminent−level data with effects data and in turn to tie these data to population−level effects. The panel recommended a smaller focused study.

Final Ranking: Adequate

Technical Review #1

proposal title: BIOMONITORING CONTAMINANT EXPOSURE AND EFFECTS IN FISH OF THE SACRAMENTO−SAN JOAQUIN DELTA

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**The goals of the project revolve around the collection of various chemical contaminants, the potential impact of these chemicals on fish health, and how these chemicals potentially impede the restoration of shallow water habitats. The objective listed on page 3 of the proposal is not very specific, and suffers from loosely defined terms. For example, the term fish health is used throughout the proposal, but it is never clearly defined. Further, the proposal seems to slip between the health of individual fish and the health of the population (which is also not clearly defined).**
Rating	**fair**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**One of my fundamental concerns with this proposal is the lack of what I consider clear justification for the scope and scale of research proposed. Being from outside of the region, I would expect there to be a clear summary of the status of the various fish**

	populations, and a clear connection to factors potentially limiting these populations. For example, if striped bass populations were very low, and there was an indication of an unknown mortality factor in juveniles, this may be an indicator that contaminants were a potential problem. On the other hand, if striped bass populations are very dense (and thus, "healthy"?), it would seem to be a fruitless task to look for strong negative impacts of contaminants. After reading the introductory material twice, I don't see anything that points to specific observed problems at the population level. To me, the vague justification that "there is a possibility that the spawning and rearing grounds may contain unforeseeable problems" is not sufficient by itself to warrant this project.
Rating	**poor**

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	**The investigators clearly have the technical skill and knowledge to accurately measure numerous chemical contaminants in sediment, water, and fish tissue. I have no qualms about this aspect of the project. I do have serious reservations about the overall "big picture" of the research. These concerns are:** **1. The proposed analysis (outlined in task 4−4) to provide a "integrated" assessment of the data collected is naive at best. Fundamental to the assessment is the idea**

that a snapshot of the chemical properties of the environment where a fish is captured are related to the fish's "health." This ignores the fact, presented in the introductory material, that many fish accumulate contaminants over time. Thus, any fish movement into or out of the environment being sampled completely confounds such an analysis. While the results of similar analyses have been published in the past (often using sophisticated multivariate techniques such as canonical correspondence analysis), it troubles me that we continue to perform these data collections/analyses that conflict so strongly with our conceptual model of how fish accumulate and respond to chemical contaminants.

2. Related to issues raised earlier, I feel that the proposal suffers from a lack of connection between the measures of individual fish health, and the health of the population. Put simply, I do not see how a measure of ill health (e.g., presence of moderate fin erosion, task 4B) would contribute to our understanding of the population's health. Similarly, I do not see how even an assessment taking into account multiple measures of an individual's health are proposed to be used to assess the overall health of the population. If the goal of the project is to understand how chemical contaminants impede the restoration of shallow water habitats, and the benefits these habitats may bring to fish populations, I feel this would be the critical connection to make.

3. Some of the proposed measures of fish "health" listed in Task 4A are very weak

	approaches. For example, the condition index, hepatosomatic index, and gonadosomatic index, while being commonly−used indices, are strongly influenced by season and feeding conditions. The authors indicate that these indices are sensitive and simple indicators of response for comparing fishes from contaminated versus reference sites, but the effects of overall food intake and season must also be considered. I did not see any methods proposed to take into account these factors into account. **As a side note, I saw no aspect of the proposed work that would address the third hypothesis listed on page 4.**
Rating	**fair**

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	**As indicated above, I feel that the collection of chemical and biological data across the range of parameters proposed is feasible, given the budget. I feel that the data analysis methods proposed, however, make completion of the project objectives infeasible.**
Rating	**fair**

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	

	Although the term monitoring is used several times in the proposal, I feel that it is more appropriate to consider this a survey of environmental conditions. As such, I feel that a rating is not applicable.
Rating	**good**

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	**One of the major products I could envision coming from this project would be a map displaying the chemical concentration and assessment of fish health across the sampling sites proposed. I fear, however, that the main conclusions that could be drawn would be that chemical contamination might be a problem requiring further investigation. I feel that the products produced would not provide a clear picture of the causal relationships, and as such, would not really clarify the situation.**
Rating	**fair**

Additional Comments

Comments	**None**

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	**The principle investigators are clearly productive and effective scientists with the knowledge and skills to successfully implement many aspects of this project. I have no reservations on their abilities to perform the chemical analysis and fish health measures proposed.**

	The authors appear to have access to all the equipment and infrastructure necessary to gather and process samples effectively.
Rating	**very good**

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	**I feel that the budget reasonably reflects the costs of performing the multitude of analyses proposed. Given my above assessment of the project justification, and my reservations on the products produced, I would not recommend supporting such a large project, however.**
Rating	**fair**

Overall

Provide a brief explanation of your summary rating.

Comments	**It is hard for me to characterize this project as anything other than a shotgun approach to data collection, with little depth of insight into what to do once the data are collected. As the investigators point out, it is a great challenge to sort out the impacts of the innumerable chemicals organisms are exposed to in the environment. I sadly don't have any deep insights to share into better ways to face this challenge, but the approach of collecting data on as many parameters as possible in the vain hope of finding some critical limitation is not one I can support.**
Rating	**good**

Technical Review #2

proposal title: BIOMONITORING CONTAMINANT EXPOSURE AND EFFECTS IN FISH OF THE SACRAMENTO−SAN JOAQUIN DELTA

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**This project proposes to examine contaminant levels in the Yolo Bypass and Motezuma Slough areas to determine whether chemicals affect fertility and survival of young at−risk and sport fish. The authors will collect fish and perform the contaminant analysis, biomarker study, and histopathology for 3 years to develop a specific index of fish health. It seems that a more appropriate path would be to collect fish only for 1 year and develop your index first.** **Assuming that can assess goal 4 on inundations to the Yolo floodplains, although you may not have an opportunity to do that portion of the study. However, if successful, this will be an important study to assess whether flooding ought to be done on a regular, managed basis.** **As described in the second paragraph of the project description/purpose, the authors state that reproductive and developmental parameters are the most important endpoints. However in the proposed tasks, the authors will collect either adult or juvenile fish. It seems very important in this type of study that you decide upon one or the other for consistency.**
Rating	**very good**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**The study should provide useful information for developing site−specific indices of fish health. There is nothing particularly novel about this proposal, but clearly understanding how contaminants affect different trophic levels of fishes in developing the health index is important. The background information and conceptual model provide appropriate justification for the project. As stated previously, it might be more beneficial to develop this project with just one year of sampling as a proof−of−concept.**
Rating	**excellent**

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	**The approach for this project is interesting in that it incorporates both the very routine chemical contaminant and biomarker analyses, and then adds histopathological measures to derive an overall indicator of fish health. If an improved program (such as AUSUM) can be developed for this project (and for other end users) that will incorporate all three parameters into one computational model, than this proposal will be very successful. That being said, there are several issues listed below that need to be reconciled before the project should be undertaken.**

	The authors propose 3 sampling stations each in the Yolo Bypass and Motezuma Slough. However, the distance between the 3 stations is not very great. For example, between station 4 and 6 is only 3 miles. Since you are proposing to sample at least several rather migratory fish (bass, stripers, salmon), you will probably not see any differences in the health or contaminant levels of those fish. Thus, it will be impossible to correlate their health with sediment levels or whether their body burdens are actually due to residence time in this specific area versus other places. In addition, there is no information given as to the homeranges of the other species (splittail, sucker, shad) so whether the stations are appropriate to examine for them cannot be discerned easily. **Under Task 2−1, it states that after biological effect measurements, that two fish species will be selected for contaminant analysis. Why only 2 species when the one of the main points of the proposal is determine differences in trophic levels and sensitive species? Why not rather do all species but instead of measuring contaminant levels in all 15−30 fish, pick only 5−8 fish from each species. And, which species will you choose: the ones most affected or least affected?** **In Task 2−3, the authors propose to remove gill, liver, kidney, gonads, and muscle for biological effect measurement. Then, the remaining portions of the fish will be used for organic analysis. Although some of the fat will remain, how high of an organic contaminant concentration do you expect to find when most of the organs and the musculature have been removed?**

	For Task 4-3, choriogenin, vitellogenin, CYP1A1, and metallothionein all have particular chemicals (or classes of chemicals) that will induce these proteins (or their enzyme activities). Thus, it makes sense to determine whether they've been induced as a biological indicator of contaminant availability or high enough levels to cause a physiological effect. However, the glutathione S-transferases and heat shock proteins are extremely general stress proteins. You really won't be able to correlate their induction (or repression) to anything specific about the health of the fish or exposure to contaminants. **Task 4-4 is the most interesting and novel aspect of this project. AUSUM is a rather good protein to incorporate histopathology with chemical contaminants to determine the health of a given system. However, beyond the statement of "we will integrate", no information is given as to how all of the biomarker data will be used to support the AUSUM program. More information is needed as to how this will work.**
Rating	**good**

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	**See comments under approach**
Rating	**very good**

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	**not applicable**
Rating	**not applicable**

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	**The investigators will use the AUSUM program to develop a site−specific index of fish health at each area. The improved program should be provided as a product for use by other investigators. Developing a website for the results of the study would also be beneficial.**
Rating	**excellent**

Additional Comments

Comments

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	**The project team's qualifications are very appropriate for the project. There is a good mix of disciplines and all investigators appear to be experts in each of the areas.**
Rating	**excellent**

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	**The budget seems excessive for the work being proposed in terms of salary, as well as to AXY for organic analysis. Certainly $2.5 million is not "cost-effective" as stated on page 15.**
Rating	**good**

Overall

Provide a brief explanation of your summary rating.

Comments	**This project proposes to examine contaminant levels, biomarkers, and histopathological studies in the Yolo Bypass and Motezuma Slough areas to determine whether chemicals affect at-risk and sport fish. They will use this information to develop a specific index of fish health. Although there is nothing particularly novel about this project, it will provide useful information, particularly if inundation of the flood plains is going to be done on a managed basis. However, it might be more beneficial to develop this project with just one year of sampling as a proof-of-concept. There are also several issues concerning the approach that need to be addressed before this project should be undertaken.** **That being said, this project will also be successful if the investigators develop (and share) an improved AUSUM program that incorporates biomarkers, residue levels, and histopathology into one computational model.**
Rating	**very good**

Technical Review #3

proposal title: BIOMONITORING CONTAMINANT EXPOSURE AND EFFECTS IN FISH OF THE SACRAMENTO−SAN JOAQUIN DELTA

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**The goals of the project are straightforward. Determine the level of a variety of contaminants in the fish using restored habitats in the Central Valley. The suite of methods proposed and targeted pollutants and biomarkers are impressive and I believe comprehensive for the study area.**
Rating	**good**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**I think the justification for the project is reasonable. Find out if there are significant levels of contaminants in the fishes using constructed/restored habitats and determine contaminant levels in the fish, sediments and water and if there are secondary signs of effects on fish health. The rationale is you need to understand if restored habitats may actually be a poor habitat for fishes and other aquatic life. The PI justifies the interests in the use of biomarkers and the approach but doesn't provide information on the current knowledge of contaminant risk for the proposed study**

	area or justify specifically why this area as opposed to other areas of the system. The conceptual model is not as well developed as it could be and may indicate a major limitation of the project. The PI talks about integration of results with ERP studies but doesn't provide details and doesn't propose a path to what should probably be the ultimate goal, the assessment of population level effects of contaminants in the study area on fishes of the central valley.
Rating	good

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	Although this work and the analyses are complex it is also fairly straighforward. It will be useful to decisionmakers to know the extent of the problem for fishes but a substantially scaled down project can do that. The approach is highly suited to determining contaminant levels and biomarkers in fish but not suited to population level extrapolations as proposed.
Rating	fair

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	I believe that all of the measurements they propose to make are feasible and the project as proposed can be done by this group. My major concern is the application of the results to populations in the field. Teh states that these results can be used to make population level assessment but nothing is

	offered as to how that will be accomplished. This is no small task. Individual health has little to do with population health and this proposal only looks at a subset of individual from a population. Without knowing something of the general health of the population of each species throughout the system any localized pollution effects on individuals may have no effect at all at the population level. Even if you knew the frequency of ill effects from the spectrum of pollutants to be studied by this project on the population that still won't tell you what the population level effect will be because there is no reasonable way to make an assessment in a dynamic population that are living and dying from a number of causes other than pollution.
Rating	**fair**

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	
Rating	**not applicable**

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	
Rating	**not applicable**

Additional Comments

Comments	**The PI seems to be unclear on exactly how the fish samples will be collected. He says others will collect the samples on their permits in one part of the proposal and then requests money to collect samples just in case. I suspect that those details haven't been worked out but he expects to make those arrangements if the project is funded.**

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	**I believe this group is highly capable of doing the proposed research as outlined. The track record of the lead PI in this area is strong and the group in general is highly capable of conducting this research.**
Rating	**excellent**

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	**This budget is huge and is padded in a number of places and ways. For example the proposal states that Teh's postdoc will do all the stats and then request 3K for statistical consultations. They request some pricey toys for histopathology analysis at 50K so they can view sample on a computer screen rather than through an eyepiece of the microscope. He also requested an ultracold freezer at 15 K. I can't believe they don't already have one. How are they holding the samples for ongoing projects? They give prices for the per sample analysis by the subcontractors but fail to do that for the inhouse ICPMS analyses.**
Rating	

	good

Overall

Provide a brief explanation of your summary rating.

Comments	**I believe the objectives of this project are worthy but it is risky for the amount of money to be spent given that it can't provide population level assessments. I also don't like a shotgun approach when were talking about such an expensive project to find out what the magnitude of the problem might be for a variety of species. If assessment of this habitat is a priority I suggest that this proposal be given consideration but at a much reduced funding level that focuses on 1 species that could provide insights into how much of contamination problem exists in this habitat, what contaminants pose the biggest risk in this habitat and how this habitat and whatever problems it poses as a degraded habitat fits into the big picture for population of a key target species. Pick a worst case scenario as a target species for the assessment among the species of highest interest. The other problem is that the PI acknowledges that the Yolo bypass may or may not be flooded for as much as 2/3rds of the project period and says they will sample in adjacent habitats if that happens. I would suggest that the PI sit down with Moyle and others that sample the habitat and look at seasonal use patterns of the fishes and discuss what species might provide the most useful insights on the effects of contaminant exposure to fish population and then target that one of those species for starters. They can archive samples of other species if they find something unususal and I suspect squeeze in a few addtional analyses in a reduced budget if warranted as a prelude to a later proposal.**
Rating	**good**